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ABSTRACT

These instructional materials are designed to help non-English speaking students in electronics classes to improve their knowledge of English. Covered in the six units are the following topics: safety, hand tools, measuring electricity, component identification, component function, and basic soldering. The lessons include readings, vocabulary lists, dialogs, aural and written drills, as well as grammar and pronunciation exercises. Although teaching electronics is not one of the goals of these materials, the lessons are organized around basic information about electronics and electricity. (MN)

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VESL
VOCATIONAL ENGLISH AS A SECOND LANGUAGE

SAN JOSE CITY COLLEGE

FOCUS: ELECTRONICS

Virginia Scales

CE 034080

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INTRODUCTION

This material will enable non-English speaking students in electronics classes to improve their knowledge of the English they need for the electronics classroom and for work. It will help them to speak and understand English better so they can be aware of instructions and directions and be able to carry them out.

There are six units dealing with areas essential to the study of electronics:

1. Safety
2. Hand Tools
3. Measuring Electricity
4. Component Identification and
5. Function
6. Basic Soldering

Included in the lessons are readings, vocabulary lists, dialogs, aural and written drills, as well as grammar and pronunciation exercises.

A good part of this material has been compiled for a VESL (vocational ESL): Focus: Electronics course which I taught for the past three semesters. The material was gathered from many different sources: analyses of classroom and lab language, consultations with electronics instructors, and research of electronics and VESL material. Each semester some material was discarded and new material was added. This set of units now presents the material proven most useful. The instructor will be able to teach for the entire semester with minimal outside research.

Students of this material will learn basic terminology and how to pronounce the words and expressions clearly and correctly. Discriminating sounds and understanding better are also goals of these lessons. While teaching the content of electronics is not one of the goals, since the language is

that of electronics, a happy result may be learning some of the basics about electronics and electricity.

In addition, each part is complete within itself so that the entire manual may be studied chronologically or out of sequence. Parts may be singled out for study, if that is desired.

The illustrations and descriptions have been made as simple and clear as possible in the hope they will be readily understood and that they will suggest to the teacher and student the innumerable applications and problems involved.

VOCATIONAL ESL, FOCUS: ELECTRONICS

UNIT I SAFETY

Lesson 1

A. Read this passage and the vocabulary. Repeat the vocabulary after the teacher.

Safe, healthy working conditions are important for all employees. You can insure a healthy, safe place to work by learning to read signs and by being alert and aware of what you are doing and of what is going on around you.

A good worker can form good safe work habits by observing the following list of safe practices.

B. Vocabulary for Safety

Nouns	Verbs	Verbs (cont'd)
safety	follow	hold
danger - hazard	touch	pick up
rule	grasp	
electric circuit	handle	
current	wear	
resistance	turn on ≠ off	Adjectives
shock	ground	
artificial respiration	interfere	safe ≠ dangerous
resuscitation	startle	hazardous = risky
risk	burn	proper = right
fatigue	set	improper = wrong
burn	reach	wet = damp ≠ dry
ground	put out - put	fatigued = tired
safety shoes	put on ≠ take off	energetic = alert
safety glasses	put in ≠ take out	neat ≠ cluttered
goggles	pull	sloppy
gloves	leave	
ring	clean	
watch	pour	
practice	wear	
wire	carry	

SAFETY RULES

A: Arrange tools and equipment so you can reach them safely and easily.

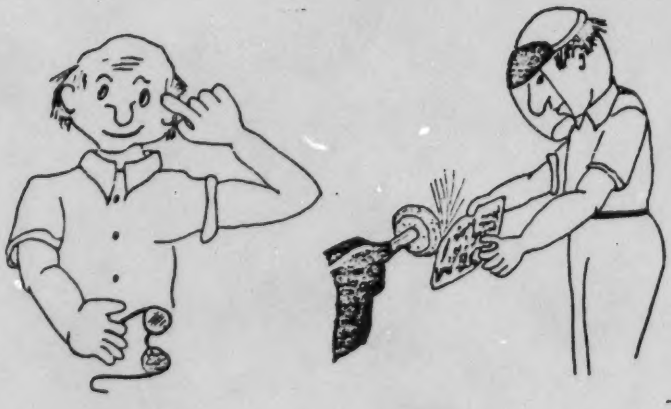
B: Why?

A: You could get burned or cut.

A: Use the proper tool for the job you are doing.

B: What happens if I don't?

A: You could injure yourself.



A: Wear safety clothing.

B: Why?

A: To protect yourself from injury.

A: Ask your instructor how to operate equipment. Learn how to read instructions.

B: Why should I do that?

A: You could hurt yourself.

A: Don't work alone.

B: Why not?

A: You won't have help in case of an accident.

A: Keep your work area clean.

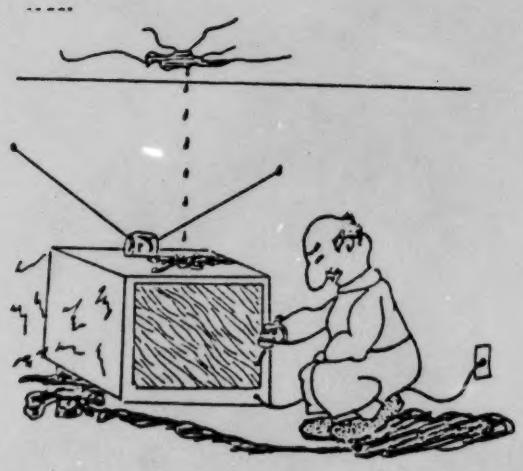
B: What can happen if I don't?

A: You can get hurt while you are doing your job.

A: Walk; don't run.

B: What if I'm in a hurry.

A: You might fall and hurt yourself.

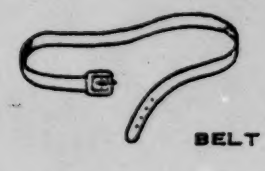


A: Don't touch electrical equipment when you are standing in a damp or wet place.

B: What can happen?

A: You will get shocked.

DRY WOOD



BELT

DRY CLOTHING

Don't touch a shock victim with your bare hands. Use dry wood, a leather belt, or dry clothing to reach the victim.

A: Turn off the power when working on electrical equipment.

B: Why?

A: You could get electrocuted.

A: Don't wear loose clothi-g, jewelry, or long hair when you are on the job.

B: What happens if you do?

A: They may get pulled into a machine.

LISTENING

Comprehension: Listen to the following statements. Complete them by choosing A, B, or C. Check the correct answer.

(Note: the statements in the parentheses is for the teacher's manual only.)

1. (You can ensure a healthy, safe place to work by . . .)

_____A. working

_____B. minding your own business

_____C. knowing what signs say and what they mean

2. (A good safety rule anywhere, anytime is . . .)

_____A. walk; do not run

_____B. keep your feet clean

_____C. learn to read English

3. (Arrange the tools on a workbench so that . . .)

_____A. the biggest ones are in front

_____B. you can reach them safely

_____C. they are in the back

4. (When working on electrical equipment, . . .)

_____A. work as quickly as possible

_____B. know the names of all the tools

_____C. turn off the power

5. (When working on live equipment, . . .)

_____A. use special tools

_____B. never use both hands

_____C. learn how to apply artificial respiration

LISTENING

Comprehension: Listen to the following statements. Complete them by choosing A, B, or C. Check the correct answer.

1. _____A. working

   _____B. minding your own business

   _____C. knowing what signs say and what they mean

2. _____A. walk; do not run

   _____B. keep your feet clean

   _____C. learn to read English

3. _____A. the biggest ones are in front

   _____B. you can reach them safely

   _____C. they are in the back

4. _____A. work as quickly as possible

   _____B. know the names of all the tools

   _____C. turn off the power

5. _____A. use special tools

   _____B. never use both hands

   _____C. learn how to apply artificial respiration

MORE SAFETY RULES

1. Know the location of all emergency power switches, so you can turn the power off.

2. Don't use both hands when working on live equipment or you will get shocked.

3. Replaced frayed or damaged wires because they might cause a fire.

4. Keep machines and tools in good condition because broken or old equipment can be dangerous.

5. Do not work when you have been drinking alcohol because you might cause an accident.

Lesson II

DIALOGS

You should ask questions to make sure you understand safety rules. The following dialogs demonstrate how to ask questions. Listen to these dialogs. Mark the stress. Then repeat them. Be prepared to say the dialogs in class.

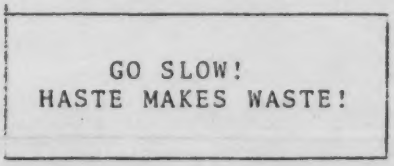
A: What does that sign say?

B: Go slow! Haste makes waste!

A: I understand 'Go slow', but what does the rest mean?

B: If you go too fast, you can make mistakes. Correcting mistakes takes a longer time.

A: I'll be very careful and go slow.



DIALOG

A: Hi Tac, what happened to you? Did you have an accident with your car?

B: No, not with my car. I was injured in the electronics lab.

A: What happened to your leg?

B: I tripped over a hammer that I forgot to put away.

A: What happened to your eye?

B: Something flew into my eye.

A: Did you get half a haircut?

B: No, the machine pulled my hair out.

A: There is a lot of danger in this job.

B: Only because I did not follow the safety rules

DIALOG

BEFORE AFTER

A: Where are you going?

B: I'm going to my class in electronics.

A: No you're not, not like that.

B: Why not?

A:	B:
You can't wear a wrist watch.	I'll take it off.
You can't wear a necklace.	I'll take it off.
You can't wear gloves.	I'll take them off.
You can't wear loose clothing.	I'll tuck in my jacket.
You can't wear long sleeves.	I'll roll them up.
You can't have sharp tools sticking out of your pocket.	I'll take them out.
You can't go barefoot.	Oh, I'll go home and get my shoes.

DIALOGS (cont'd)

A: Watch out!

B: What's the matter?

A: Stop! Don't do that!

B: Why not?

A: It's dangerous.

B: What am I doing wrong?

A: You shouldn't _____

1. PULL THE PLUG BY THE CORD. GRASP THE PLUG INSTEAD.
2. TOUCH ELECTRICAL EQUIPMENT WHILE YOUR HANDS ARE WET.
3. TOUCH ELECTRICAL EQUIPMENT WHILE STANDING ON A METAL FLOOR.
4. PUT BOTH HANDS ON LIVE EQUIPMENT. PUT ONE HAND IN YOUR POCKET.
5. REACH ACROSS THE SOLDERING IRON LIKE THAT. MOVE IT CLOSER TO YOU.

Lesson III

EXERCISES

A. TRUE/FALSE

Read the following statements. Write T in the blank if the statement is true, F if it is false.

1. _____Take off your wristwatch, but leave on your rings.
2. _____Don't wear long sleeves.
3. _____Come to class well dressed; wear a necktie.
4. _____Your instructor wants you to be happy; have a drink before you come to class.
5. _____Don't wear goggles; they get in the way.
6. _____Rush and run so your work gets done.

MATCHING

Match the safety rule on the left with the correct phrase on the right.

_____1.	You should walk slowly.	A.	You might cause an accident.
_____2.	You should not wear long hair.	B.	You might get shocked.
_____3.	You should not work when you have been drinking.	C.	You might slip.
_____4.	You should work alone.	D.	Something sharp might injure your eye.
_____5.	You should turn the power off when working on electrical equipment.	E.	You won't have help in case you get hurt.
_____6.	You should wear safety glasses.	F.	You can avoid accidents when doing your job.
_____7.	You should keep your work area clean.	G.	A machine might pull it in.

LANGUAGE

Pronunciation from the reading passage:

1. to be alert /ə- lírt/ wide awake, able to sense everything
2. to ensure /en - šúr/ make certain
3. to be aware /ə- wár/ know what is happening
4. loose /luws/ not tight
5. give artificial respiration /ar - ti - fí - šəl - re - spir - éy - šən/ a way to revive someone who has stopped breathing
6. in good condition / gud - kən - dí - šən/ ready to use; not broken
7. the proper tool /prá - pir - túl/ the one made for the job you are doing
8. electrical equipment /iy - lék - triy - kəl - iy - kwíp - ment/ equipment that works by electricity
9. location /low - kéy - šən/ place
10. frayed /freyd/ coming apart
11. damaged /dǽ - mɪ dǰd/ broken
12. live equipment /lai - viy - kwíp - ment/ equipment that has an electrical charge
13. device /diy - vaís/ a tool or piece of equipment

ENGLISH ALPHABET

Listen to and repeat the letters of the English alphabet.

A	/ey/	F	/ef/	K	/key/	O	/ow/	S	/es/	W	/dəbəyuw/
B	/biy	G	/dǰiy/	L	/el/	P	/piy/	T	/tiy/	X	/eks/
C	/siy	H	/eytš/	M	em/	Q	/kyuw/	U	/yuw/	Y	/wai/
D	/diy	I	/ai/	N	/en/	R	/ar/	V	/viy/	Z	/ziy/
E	/ey/	J	/dǰey/								

Commands

Safety rules are usually given in commands. Commands are sentences telling you what to do. Example: Walk: don't run. Complete these safety rules with the correct verb.

1. _____your work area clean.

2. _____safety glasses and safety clothing.

3. _____the proper tool for the job you are doing.

4. _____machines and tools in good condition.

5. _____tools and equipment so you can reach them easily and safely.

Often safety rules are expressed in negative commands, sentences telling you what not to do. Example: Don't touch live equipment. Complete these safety rules with the correct negative verb.

1. _____ _____loose clothing.

2. _____ _____alone.

3. _____ _____jewelry when you are on the job.

4. _____ _____both hands when working on live equipment.

5. _____ _____on electrical equipment when your hands or feet are wet.

The Phonetic Alphabet

SYMBOL	ENGLISH EXAMPLES	
Simple Vowels		
1. /a/	far	/far/
	hot	/hat/
2. /æ/	am	/æm/
3. /ɛ/	get	/gɛt/
	bread	/brɛd/
	said	/sɛd/
4. /ɪ/	in	/ɪn/
	become	/bɪkə́m/
5. /ɔ/	for	/fɔr/
	all	/ɔl/
	ought	/ɔt/
6. /ʊ/	put	/pʊt/
	could	/kʊd/
	good	/gʊd/
7. /ə/[2]	but	/bət/
	bird	/bərd/
	other	/ə́ðər/
	ago	/əgów/
	reason	/ríyzən/

The Phonetic Alphabet

SYMBOL	ENGLISH EXAMPLES		APPROXIMATE EQUIVALENT IN FRENCH	GERMAN	JAPANESE	SPANISH
Diphthongs[3]						
1. /ey/	late	/leyt/	thé	Leben	eigo	peine
	raise	/rayz/				
2. /iy/	see	/siy/	fini	sieht	ie	sí
	receive	/rɪsiyv/				
3. /ow/	go	/gow/	dôme	Boot	hirou	bou
	coat	/kowt/				
4. /uw/	rule	/ruwl/	fou	Stube	kū	mula
	too	/tuw/				
5. /ay/	I	/ay/	aïe	mein	ai	hay
	cry	/kray/				
6. /aw/	now	/naw/	(none)	Haupt	au	pausa
	house	/haws/				
7. /ɔy/	boy	/bɔy/	(none)	heute	oi	sois
	noise	/nɔyz/				

The Phonetic Alphabet

SYMBOL		ENGLISH EXAMPLES	
Consonants			
1.	/b/	boat	/bowt/
2.	/d/	dark	/dark/
3.	/f/	far	/far/
4.	/g/	gold	/gowld/
5.	/h/	home	/howm/
6.	/k/	cold	/kowld/
		kodak	/kówdæk/
7.	/l/	let	/lɛt/
8.	/m/	man	/mæn/
9.	/n/	next	/nɛkst/
10.	/ŋ/	ring	/rɪŋ/
		sink	/sɪŋk/
11.	/p/	part	/part/
12.	/r/	rest	/rɛst/
13.	/s/	send	/sɛnd/
		city	/sítɪ/
14.	/š/	ship	/šɪp/
15.	/t/	ten	/tɛn/
16.	/θ/	think	/θɪŋk/

17.	/ð/	that	/ðæt/
18.	/v/	very	/vɛ́rɪ/
19.	/w/	went	/wɛnt/
20.	/y/	you	/yuw/
21.	/z/	zoo	/zuw/
		rose	/rowz/
		knows	/nowz/
22.	/ž/	pleasure	/plɛ́žər/
		vision	/vížən/
23.	/hw/	when	/hwɛn/
24.	/tš/	children	/tšíldrən/
25.	/dž/	jury	/džúrɪ/
		edge	/ɛdž/
		age	/eydž/

UNIT II HAND TOOLS

Lesson I

A. Read this passage.

Using the right tool for the job you are doing makes your job easier and allows you to finish the work fast. You may have already used many of the tools we are going to learn about. You should be able to identify the tools and tell what each one is used for. People who work in electronics will be especially interested in such tools as pliers, wire strippers, and soldering irons.

Vocabulary for Hand Tools

Nouns

bench vise
bolts
chisel
file
hacksaw
hammer
electric drill
pliers
metal
micrometer
punch
screwdriver
scriber
Phillips screwdriver
soldering iron
vernier caliper
wrench
function
screws
tinsnips

Verbs

pound
loosen
tighten
hand
strip
measure
support
checkout
hold
drill
bend
adjust
peen
fasten

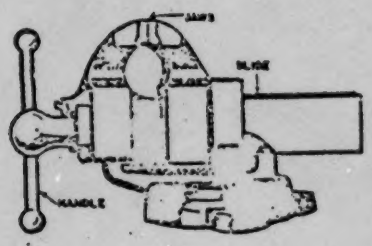
Structures

What is the _____ used for?
What is the function of a _____?
What is that?
What kind of _____ is that?
What kind of _____ are these?
We're out of _____.
What's another name for _____?

HAND TOOLS AND THEIR FUNCTIONS

A: What's this?
B: It's a bench vise.

A: What is its function?
B: It holds pieces of work in place.



A: What are these?
B: They are bolts.

A: What are they used for?
B: They hold two parts together.

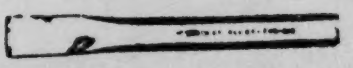
STOVE BOLTS

CARRIAGE BOLT

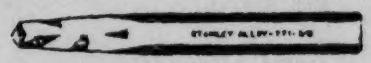
SQUARE HEAD MACHINE BOLT

A: What's the name of these tools?
B: They are called chisels.

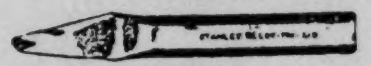
A: What is their function?
B: Chipping broad, flat surfaces in different shapes.



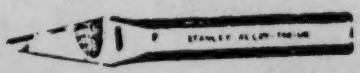
4-5 Flat "cold" chisel



4-7 Diamond-point chisel

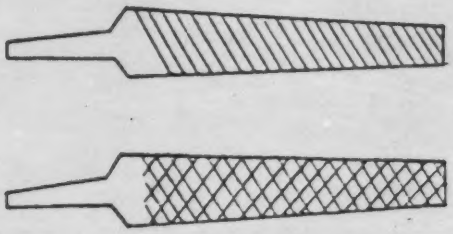


4-8 Round nose cape chisel



4-6 Flat cape chisel

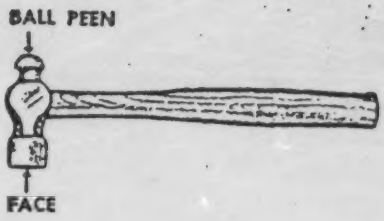
A: What are these?
B: These are files.



A: What are they used for?
B: Removing metal and finished surfaces.

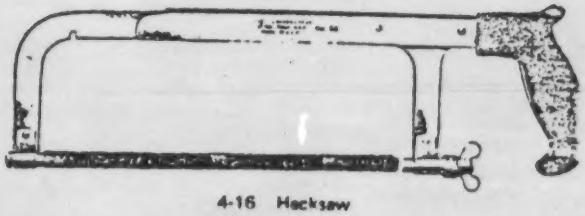
A: How about these?
B: These are hammers.

A: Are they used to drive nails?
B: The top one is a claw hammer
It's used to drive nails.
The bottom one is a ball peen hammer for shaping metal.



A: What do you call this?
B: A hacksaw.

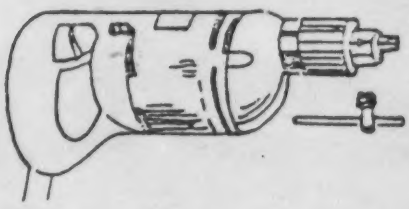
A: What's it for?
B: Cutting heavy metal.



4-16 Hacksaw

A: How about this one?
B: This is an electric drill.

A: What's it used for?
B: To cut holes in metal.

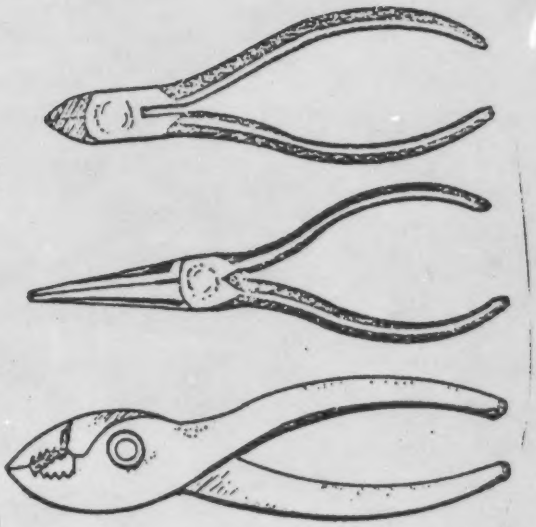


A: What are these?
B: They are pliers.

A: What kind of pliers are the top ones?
B: Side cutter pliers for cutting heavy gauge wire.

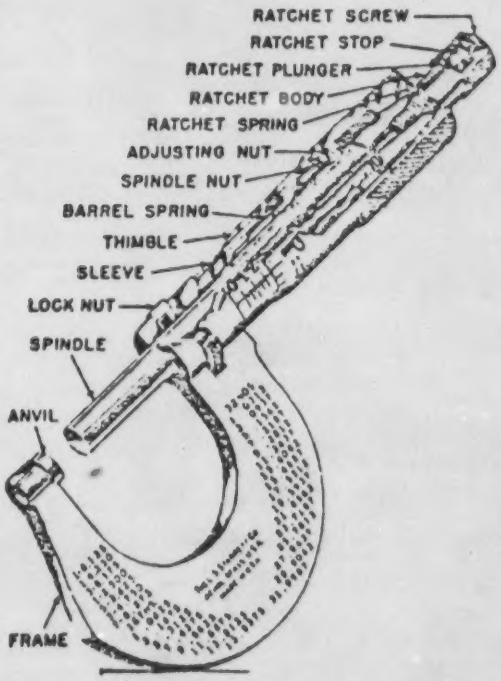
A: How about the middle ones?
B: Those are needle nose pliers used to form wire and hold very small parts.

A: And these?
B: Those are called slip joint pliers. They are used for bending and looping wire and holding parts in place.

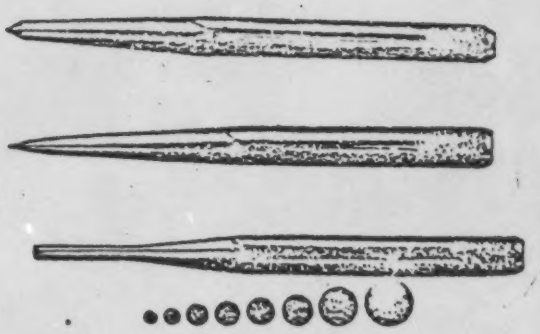


A: Is this a drill?
B: No, it's a micrometer.

A: What is its function?
B: It's used for taking precision measurements.



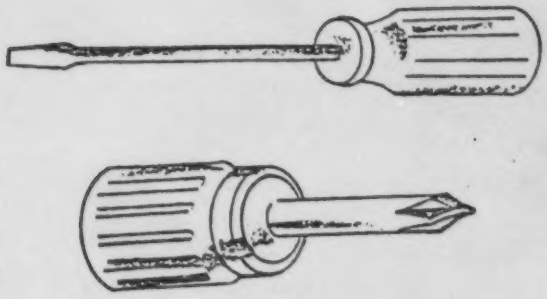
A: Tell me about these tools.
B: These are called punches. The top one is a center punch. It's used to mark the place for a hole to be drilled. The middle is a prick punch for marking layout work. The bottom one is a pin punch. It is used to remove taper pins, straight pins, keys, and small shafts from mechanical assemblies.



A: What are these?
B: Screwdrivers.

A: What kind of screwdriver is the top one?
B: It's a regular screwdriver. It's used to loosen or tighten regular screws.

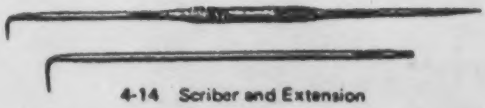
A: What about the other one?
B: That's a Phillips screwdriver for tightening and loosening Phillips screws.



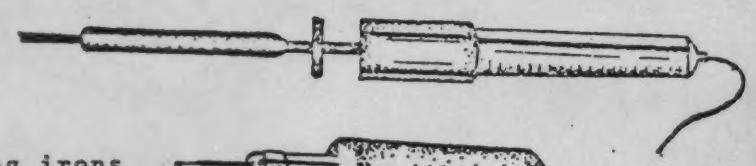
A: Is this a chisel?
B: No, this is a scriber.

A: What is its function?
B: It's used to mark patterns on metal or plastic.

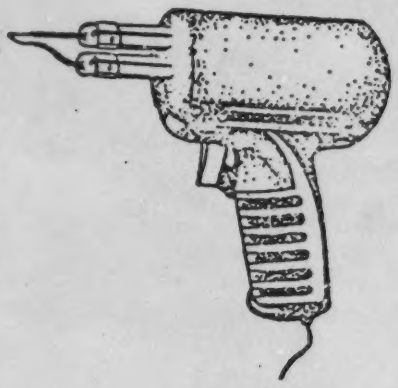
4-13 Pocket scriber



4-14 Scriber and Extension

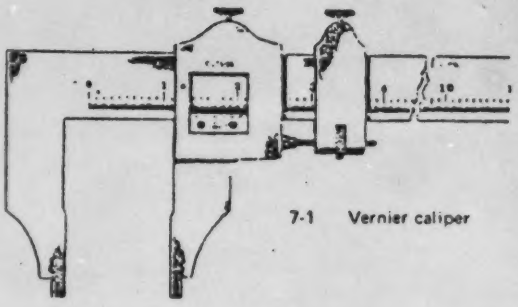


A: What are these?
B: These are soldering irons.



A: What are they used for?
B: They are used to join two pieces of metal together.

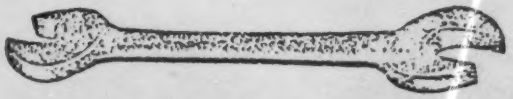
A: What's this?
B: It's called a vernier caliper.



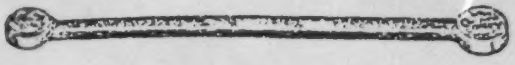
7-1 Vernier caliper

A: What is its function?
B: It's used for making precision measurements.

A: What about these?
B: Those are wrenches.

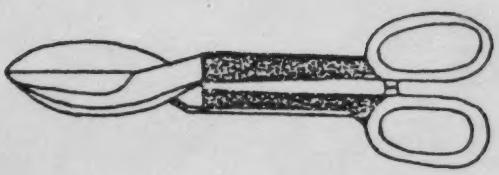


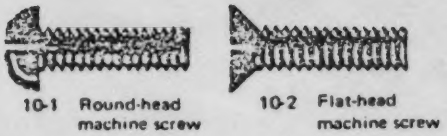
A: What are they used for?
B: Loosening and tightening bol and nuts.



A; What are these?
B: These are tinsnips.

A: What is their function?
B: they cut sheet metal.





10-1 Round-head machine screw

10-2 Flat-head machine screw

A: What are these?
B: These are screws.

A: Tell me their function.
B: They fasten parts together.

10-4 Self-tapping sheet metal screws

10-5 Self-tapping screws

10-6 Sheet metal screw, Phillips head.

LISTENING

Comprehension: Listen to the following statements. Complete them by choosing A, B, or C. Check the correct answer.

(Note: the statements in the parentheses is for the teacher's use only.)

1. (I need a ball peen hammer to . . .)

_____A. pound nails

_____B. peen metal

_____C. cut cloth

2. (I have to cut this metal. Please hand me . . .)

_____A. the pliers

_____B. the file

_____C. the hacksaw

3. (Please hand me the tinsnips to . . .)

_____A. tighten this bolt

_____B. cut this piece of cast iron

_____C. cut this piece of light sheet metal

4. (Can you get me a soldering iron?)

_____A. These two metal parts need to be joined together.

_____B. This bracket needs holes punched in it.

_____C. This surface needs holes marked on it.

5. (I have to get a drill for . . .)

_____A. connecting two pieces of wire

_____B. cutting these pieces of metal

_____C. making holes in this chassis

Listening Comprehension (cont'd)

6. (I will need a wrench to . . .)

_____A. loosen these bolts

_____B. tighten this screw

_____C. join these parts

7. (Could I borrow the pliers? I need to . . .)

_____A. tighten this screw

_____B. make a hole in this hinge

_____C. hold this wire in place while I solder

8. (Would you lend me your chisel? I have to. . .)

_____A. cut this metal so it will be the right size

_____B. cut this piece of sheet metal

_____C. mark a hole on this metal plate

LISTENING

Comprehension: Listen to the following statements. Complete them by choosing A, B, or C. Check the correct answer.

1. _____A. pound nails
   _____B. peen metal
   _____C. cut cloth

2. _____A. the pliers
   _____B. the file
   _____C. the hacksaw

3. _____A. tighten this bolt
   _____B. cut this piece of cast iron
   _____C. cut this piece of light sheet metal

4. _____A. These two metal parts need to be joined together.
   _____B. This bracket needs holes punched in it.
   _____C. This surface needs holes marked on it.

5. _____A. connecting two pieces of wire
   _____B. cutting these pieces of metal
   _____C. making holes in this chassis

6. _____A. loosen these bolts
   _____B. tighten this screw
   _____C. join these parts

Listening Comprehension (cont'd)

7. _____A. tighten this screw

_____B. make a hole in this hinge

_____C. hold this wire in place while I solder

8. _____A. cut this metal so it will be the right size

_____B. cut this piece of sheet metal

_____C. mark a hole on this metal plate

Lesson II

DIALOGS

The following dialogs should be repeated using the functions and names of the tools where there are blank spaces. Be prepared to say the dialogues in class.

A: May I check out a Phillips screwdriver and tinsnips?

B: Sure. I'll see what we have left. Here you are. Anything else?

A: No, I don't think so.

B: Sign your name and the date on this line.

A: Oh, I almost forgot. I need pliers too.

B: Let's see what we have. We're in luck. Here's a pair.

A: When do I have to return these?

B: Two weeks from today.

A: Thanks again.

A: May I borrow a screwdriver? I can't find mine.

B: If you remember to give it back. Here.

A; No, not that one, not the regular screwdriver.

B: What do you want it for?

A: I need it to tighten this screw.

B: Oh, you need a Phillips screwdriver.

A: Thanks a lot. I'll bring it right back.

DIALOGS (cont'd)

A: What are the most important tools for an electronics worker?

B: Many tools are important, but two really necessary ones are the soldering iron and pliers.

A: Could you explain what they are?

B: Sure. The soldering iron is a tool that is used to unite two pieces of metal, like two pieces of copper.

A: How does it do that?

B: By heating a third metal until it melts. The heat from the third metal causes some melting on the two pieces and they form a solid piece.

A: What kind of metal is the third metal?

B: It's usually a mixture of tin and lead. It's called an alloy.

A: that's very interesting.

A: Can I help you?

B: Yes. I need a tool that _____.

A: Oh, you need a _____.

A: That's right. Thanks a lot.

A: Do you need some help?

B: I'd like to buy this _____
How much is it?

A: $13.00.

B: That's expensive. I'll come back later.

DIALOGS (Cont'd)

A: I need a hacksaw.

B: Sorry, we're all out.

A: When will you get more in?

B: Possibly next week.

A: We only have that tool in 7/8 inch.

B: I can't use that size. Will you be getting the smaller ones in?

A: Yes, they are on order.

A: Here is the tool you want. Is this the right size?

B: Just right. I'll take it.

A: All right. This way. We'll take it to the cashier.

Lesson III

EXERCISES

A. LISTENING COMPREHENSION

Listen to the teacher read the function. Write the name of the tool that we use to perform that function.

1. _____ 6. _____

2. _____ 7. _____

3. _____ 8. _____

4. _____ 9. _____

5. _____ 10. _____

LISTENING COMPREHENSION (cont'd)

Listen to the name of the tools. Write down the function of the tool whose name you hear.

1. _____

2. _____

3. _____

4. _____

5. _____

MATCHING

Match the tools with the correct functions. Put the correct letter in the blank.

_____1.	Holds and tightens nuts and bolts	A.	chisel
_____2.	cuts heavy metal	B.	caliper
_____3.	Marks a pattern on metal	C.	ballpeen hammer
_____4.	Makes measurements	D.	hacksaw
_____5.	Makes holes in metal	E.	wrench
_____6.	Peens metal	F.	soldering iron
_____7.	Makes inside and outside measurements	G.	scriber
_____8.	Loosens and tightens screws	H.	micrometer
_____9.	Joins two metals together	I.	punch
____10.	Chips broad, flat surfaces	J.	screwdriver

LANGUAGE

Pronunciation from the reading passage

1. wrenches /rén - tʃiz/
2. boxend /bak - sénd/
3. ball peen hammer /bal - piyn - hǽ - mir/
4. chisel /tʃíz - ɔl/
5. drill /dril/
6. hacksaw /hǽk - sa/
7. pliers /plaí - irz/
8. screwdriver /skrúw - drai - vir/
9. soldering iron /sá - dir - in - airŋ/
10. stright /streyt/

Cardinal and Ordinal Numbers: cardinal numbers indicate quantity. Ordinal numbers indicate rank.

Cardinal Numbers

1	one	30	thirty
2	two	40	forty
3	three	50	fifty
4	four	60	sixty
5	five	70	seventy
6	six	80	eighty
7	seven	90	ninety
8	eight	100	a hundred
9	nine	101	a hundred and one
10	ten	102	a hundred and two
11	eleven	200	two hundred
12	twelve	300	three hundred
13	thirteen	1000	a thousand
14	fourteen	1001	a thousand one
15	fifteen	1,564	one thousand five hundred and
16	sixteen		sixty four
17	seventeen	10,000	ten thousand
18	eighteen	100,000	one hundred thousand
19	nineteen	1,000,000	a million
20	twenty	1,000,000,000	a billion
21	twenty-one		
22	twenty-two		
23	twenty-three		

Ordinal Numbers

1st	first	100th	hundredth
2nd	second	101st	hundred and first
3rd	third	102nd	hundred and second
4th	fourth	200th	two hundredth
5th	fifth	300th	three hundredth
6th	sixth	1000th	thousandth
7th	seventh	1,564th	thousand, five hundred sixty fourth
8th	eighth		
9th	ninth	10,000th	ten thousandth
10th	tenth	100,000th	one hundred thousandth
11th	eleventh	1,000,000th	millionth
12th	twelth	1,000,000,000th	billionth
13th	thirteenth		
14th	fourteenth		
15th	fifteenth		
16th	sixteenth		
17th	seventeenth		
18th	eighteenth		
19th	nineteenth		
20th	twentieth		
21st	twenty-first		
22nd	twenty-second		

Requests and Favors

When you want to use something that belongs to another person, you can use the words lend or borrow. Don't confuse them. If a classmate or a friend has a screwdriver, but you don't have one, you borrow your friend's pen. Your friend lends the pen to you.

You can say--

May I please borrow your _____.

Would you please lend me your _____.

Would you mind lending me your _____.

Lend or Borrow: Tell whether the following sentences are right or wrong.

1. Could I lend your pliers, please? Right / Wrong

2. May you borrow me the screwdriver? Right / Wrong

3. Would you lend me the hammer? Right / Wrong

4. May I borrow that wrench? Right / Wrong

5. I have a wrench. Do you want me to borrow it? Right / Wrong

6. I'll lend you my punch. Right / Wrong

7. You can lend my chisel. Right / Wrong

Fill in the word lend or borrow, whichever is correct.

1. Can you _____ me a wrench?

2. May I _____ the screwdriver?

3. Could you _____ me your drill?

4. Can I _____ your tinsnips?

5. I can _____ you the soldering iron.

6. I'll _____ the hacksaw from Vuong.

7. I need to _____ a caliper from Ngo.

8. I'll _____ the micrometer to Paul.

9. I'm going to _____ the scriber from Tom.

UNIT III MEASURING ELECTRICITY

Lesson I

Read the passage.

Electricity has its origin in the electron. Although electricity is not tangible, we can measure and see its effects. Just as units of measure for money, weight, and size have been established, various units of measure for electricity have made it possible for us to have definite, common values.

In this unit, we will learn terms of electrical measurement and the definitions of those terms. Basic calculations for measuring values will be introduced.

Vocabulary: Repeat for correct pronunciation.

Nouns	Verbs
electric current	flow
conductor	consists of
insulator	made up of
rubber	composed of
electromotive force	conduct
voltage	generate
resistance	indicate
ampere	insulate
volt	resist
ohm	represents
Ohm's Law	calculate
gold	
silver	
copper	
aluminum	
element	
formula	
symbol	
fraction	
numerator	
denominator	

Numerical Terms

Electricity is measured in units whose names are formed with prefixes, some of which are included here.

deca	(10)	deci	(10^{-1})
hecto	(10^{2})	centi	(10^{-2})
kilo	(10^{3})	milli	(10^{-3})
mega	(10^{6})	micro	(10^{-6})
giga	(10^{9})	nano	(10^{-9})
tera	(10^{12})	pico	(10^{-12})

Vocabulary (continued)

Calculations: how to express the numbers and language of calculations.

3 + 2 = 5	three plus two equals five
3 - 2 = 1	three minus two equals one
3 x 2 = 6	three times two equals six
6 - 2 = 3	six divided by two equals three

Note:

2, 4, 6 . . . are even numbers.

1, 3, 5 . . . are odd numbers.

3, 5, 7, 11 are prime numbers, that is, no number can divide into them evenly.

$3^2 = 9$ three squared equals nine

$64 = 8$ the square root of sixty four is eight.

$3^3 = 27$ three cubed is twenty seven.

$3^{12} =$ three to the twelth power

$10^{-5} =$ ten to the minus five power

$j = -1$ j equals the root of minus one.

Working on numbers

Write the following numbers in words.

1. 201 _____
2. 75% _____
3. 437 _____
4. 980 _____
5. 511 _____
6. 44% _____
7. 1/2 _____
8. 1/1723 _____
9. 13.28 _____
10. .06 _____
11. 10^{-4} _____
12. 1st _____
13. 2/3 _____
14. 9/8 _____
15. 1,845 _____
16. 3/4 _____

COMPREHENSION

Listening: True or False

Listen to the statements the teacher reads. Mark T in the blank if the statement is True and F if the staement is false.

(Teacher's Script)

1. Electricity has its origin in the proton.
2. We can see electricity.
3. A formula is a rule.
4. Gold is a basic element.
5. We can measure electricity.
6. An atom is found inside a neutron..
7. Protons have a positive charge.
8. Resistance is the pressure to make electrons flow.
9. Amperage is the strength of the current flow.
10. We use Ohm's law to measure resistance.

Students' Answer Sheet

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

Lesson II

FINDING OUT HOW TO MEASURE ELECTRICTY: ASKING QUESTIONS

What is an electron?

Sang: Since you have studied chemistry, maybe you can help me. Do you understand what "atom" means?

Thanh: I'm not sure. But I know everything in the world is made up of atoms.

Sang: Is that right? What do the atoms do?

Thanh: They join together to form molecules.

Sang: What happens to the molecules then?

Thanh: The molecules join together to form the basic elements.

Sang: Can you tell what the basic elements are?

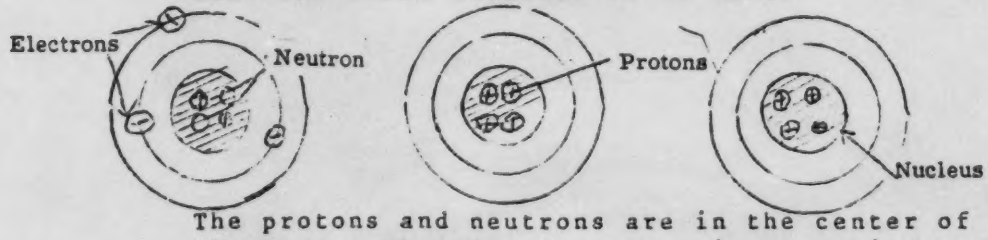
Thanh: Sure. That's easy. At least I know some of them: gold, silver, lead, copper, zinc, iron ore, and carbon.

Sang: I still don't understand about the atom. Let's go ask Mr. Barringer.

Thanh: Okay. Maybe he knows the answer.

Sang: Mr. Barringer, can you help us? Can you explain what an atom is?

Mr. Barringer: I'll try. An atom is made up of smaller particles. They are called protons, neutrons, and electrons. Let's draw some sketches to show the three elements of an atom.



The protons and neutrons are in the center of the atom. The electrons move in an orbit around the edge of the atom. Protons have a positive charge. Electrons have a negative charge. Different elements have different numbers of protons, neutrons, and electrons.

Sang: It's a little clearer. Now what does all this have to do with electricity?

Mr. Barringer: An electric current is the movement of the electrons in the atoms through a wire. Voltage is the pressure to make electrons flow. Amperage is the strength of the current flow. It's also called electromotive force. Resistance is the opposition to the current flow. These are the phenomena we have to measure in electricity.

Thanh: I think I understand it a little better. Now how do we measure voltage, amperage, and resistance?

Mr. Barringer: It sounds pretty simple, but of course it's not. To begin, voltage is measured in volts, amperage is measured in amperes, and resistance is measured in ohms.

We have symbols for these units of measure.
The symbol for voltage is E.
The symbol for amperage or current is I.
The symbol for resistance is R.

Sang: But why do you need the symbols?

Mr. Barringer: Because the symbols are easier to use when we do mathematical calculations.

These three symbols are used in the formula called Ohm's law. It's the formula we use to measure current.

Thanh: What's the formula?

Mr. Barringer: $I = E/R$ $E = IR$ $R = E/I$

Sang: How do we use this formula?

Mr. Barringer: The rest of this lesson will give you practice with that.

ELECTRONICS MEASURING TERMINOLOGY: FORMULAS

1. Let's look at the three symbols in Ohm's Law again.

   A. E represents voltage in volts.

   B. I represents current in amperes.

   C. R represents resistance in ohms.

2. To do the calculations we need to understand the parts of a fraction.

   A. Numerator is the top number of a fraction.

   B. Denominator is the bottom number of a fraction.

3. Let's look at the formula for calculating the amount of current, voltage, or resistance.

   OHM'S LAW I = E/R E = IR R = E/I

4. Determine I or current if there are 10 volts and 5 ohms.

   I = E/R I = 10/5

   10/5 = 2 I = 2 amperes

5. Determine R if there are 12 volts and 6 amperes.

   R = E/I R = 12/6

   12/6 = 2 R = 2 ohms.

6. Find the voltage if there are 3 amperes and 5 ohms.

   E = IR E = 3 x 5

   E = 15 volts

Lesson Three

Exercises

FORMULA AND WORD PROBLEMS AND THEIR VOCABULARY

1. Find the voltage if R = 20 ohms and I = 0.5 amperes.

First write the formula. _____

Then write the formula using the known quantities. _____

Next do the calculations. _____

You say -- E equals IR. IR means I times R. I is 0.5 amperes. R is 20 ohms. So E equals twenty times 0 point five. Twenty times 0.5 equals 10.0. The decimal point in front of the five is moved after the five.

Now try these problems following the same steps.

A. R = 20. I = 0.5. E = _____

B. R = 560. I = 0.02. E = _____

C. R = 1,000. I = 0.01. E = _____

D. R = 20. I = 1.5. E = _____

2. Find the amperage if the voltage is 1 and the ohms are 2.

The formula is _____

The formula in quantities _____

Calculations: _____

You say -- E equals one and R equals two. The formula is I equals E times R. E times R equals 1/2 or 0.5. So I equals 0.5.

Now try these problems using the same steps.

A. E = 1. R = 2. I = _____

B. E = 2. R = 10. I = _____

C. E = 10. R = 3. I = _____

D. E = 120. R = 100. I = _____

3. Find R when E and I are given. E is 1 and I is 1.

The formula is _____

The formula in quantities is _____

Calculations: _____

You say -- R equals E over I. In this problem, R equals 1 over 1. One over one is one. So R = 1.

Complete these problems the same way.

A. E = 1. I = 1. R = _____

B. E = 2. I = 0.5. R = _____

C. E = 10. I = 3. R = _____

D. E = 50. I = 20. R = _____

4. Work through these problems. In each one, two quantities are given and you must find the third.

A. 12 volts and 10 ohms. Find the current.

B. 24 volts and 8 amperes. Find the resistance.

C. 5 amperes and 75 ohms. Find the voltage.

5. Resistance: Many resistors can be connected. The figure shown below shows two resistors in a series.

What is the total resistance?

You get the total by adding the ohms together.

The total resistance equals the sum of resistor 1 (R1) and resistor 2 (R2). 10 + 5 = 15.

The total is 15.

6. Resistors can be connected in parallel. This is the formula for "equivalent parellel resistance"

   $1/Rt = 1/R1 + 1/R2$

   Let's look at a resistor with parallel ohms.

   R1 2

   R2 2

   The total equals one over two + one over two.

   So $1/R^t = 1/2 + 1/2$. $1/2 + 1/2 = 1$

7. This formula for equivalent parallel resistance can be extended to include as many resistors as are desired.

   The formula for three resistors in parallel:

   $1/R^t = 1/R1 + 1/R2 + 1/R3$

8. Find the total resistance or total equivalent resistance in these problems.

   A. R1 = 1 R2 = 1 R^t = _____

   B. R1 = 1,000. R2 = 500. R^t = _____

   C. R1 = 3,600. R2 = 1,800 R^t = _____

MEASURES AND EQUIVALENTS

Converting English and Metric Systems

1 meters to yards, multiply the number of meters by 1.09.

2 yards to meters, multiply the number of yards by .91.

3 meters to inches, multiply the number of meters by 39.37.

4 inches to meters, multiply the number of inches by .0254.

5 millimeters to inches, multiply the number of millimeters by .04.

6 inches to millimeters, multiply the number of inches by 25.4.

7 kilometers to miles, multiply the number of kilometers by .62.

8 miles to kilometers, multiply the number of miles by 1.61.

9 liters to liquid quarts, multiply the number of liters by 1.06.

10 liquid quarts to liters, multiply the number of liquid quarts by .95.

11 liters to dry quarts, multiply the number of liters by .91.

12 dry quarts to liters, multiply the number of dry quarts by 1.1.

13 kilograms to pounds, multiply the number of kilograms by 2.2.

14 pounds to kilograms, multiply the number of pounds by .45.

15 centimeters to inches, multiply the number of centimeters by .4.

16 inches to centimeters, multiply the number of inches by 2.54.

MEASURE OF LENGTH

Metric to English units:

1 meter = 39.37 inches
= 3.28 feet
= 1.09 yards
1 centimeter = .4 inch
1 millimeter = .04 inch
1 kilometer = .62 mile

English to metric units:

1 inch = 25.4 millimeters
= 2.54 centimeters
= 0.254 meter
1 foot = .3 meter
1 yard = .91 meter
1 mile = 1.61 kilometers

Capacity - liquid measure
Metric to English units:

1 liter = 1.06 liquid quarts

English to metric units:

1 liquid quart = .95 liter

Capacity - dry measure
Metric to English units:

1 liter = .91 dry quart

English to metric units:

1 dry quart = 1.1 liters

MEASURE OF WEIGHT

Metric to English units:

1 gram = .04 ounce
1 kilogram = 2.2 pounds
1 metric ton = 2204.62 pounds

English to metric units:

1 ounce = 28.35 grams
1 pound = .45 kilogram
1 short ton = .91 metric ton

MEASURE OF AREA

Metric to English units:

1 square centimeter = .16 square inches
1 square meter = 10.76 square feet
= 1.2 square yards
1 square kilometer = .39 square miles

English to metric units:

1 square inch = 6.45 square centimeters
1 square foot = .09 square meter
1 square yard = .84 square meter
1 square mile = 2.59 square kilometers

MEASURE OF VOLUME

Metric to English units:

1 cubic centimeter = .06 cubic inch
1 cubic meter = 35.31 cubic feet
1 cubic meter = 1.31 cubic yards
1 liter = .04 cubic foot

English to metric units:

1 cubic inch = 16.39 cubic centimeters
1 cubic foot = .03 cubic meter
1 cubic yard = .76 cubic meter
1 cubic foot = 28.32 liters

English measures

weight

ounce (oz.)
  16 oz. = 1 lb.
pound (lb.)

length

inch (in. or")
  12" = 1'
foot (ft. or ')
  3' = 1 yd.
yard (yd.)
  1760 yds = 1 mi.
mile (mi.)

liquid

pint (pt.)
  2 pts. = 1 qt.
quart (qt.)
  4 qts. = 1 gal.
gallon (gal.)

LANGUAGE

Pronunciation

Repeat the words with the e sound.

electric	hecto	chemistry
element	lead	problem
generate	deci	center
represents	centi	pressure
deca	electron	phenomenon
represents	problem	

Repeat the words with the ey sound.

generate	basic
calculate	made
mega	indicate
measure	insulate
weight	name

Pronunciation of Numbers

Decimals

20.95	twenty point nine five	/twén - diy point nain - faív/
3.14	three point one four	/θriy - point - wán for/
1.333	one point three three three	/wən - point θríy - θríy - θríy/
1.05	one point 0 five	/wən - point ow - faív/
.25	point two five	/point - tuw - faív/
.0001	point 000 one	/point ow - ow - ow - wən/
9.80665	nine point eight 0 six six five	/nain - point - eyt - ow - siks - siks - faív/

Fractions

5/4	five over four /faiv - ow - ver - for/
1 1/3	one and one third or one and a third
7/8	seven eighths
3/4	three quarters or three fourths / riy - kwoiterz riy - for s/
2/3	two thirds /tuw - irdz/
5/8	five eighths /faiv - ey s/
1/2	a half or one half / - ha f w n - ha f/
3/8	three eighths
1/3	one third or a third
1/4	a quarter or one quarter or one fourth
1/8	one eighth
1/10	one tenth or a tenth
1/100	one hundredth or a hundredth
1/167	one one sixty seventh
1/1836	one over one thousand eight hundred thirty six
1/n	one over n

Pronunciation Exercise

Check whether the word is pronounced /ey/ or /e/.

		/ey/	/e/
1.	name	_____	_____
2.	problem	_____	_____
3.	indicate	_____	_____
4.	measure	_____	_____
5.	represents	_____	_____
6.	element	_____	_____
7.	hecto	_____	_____
8.	mega	_____	_____
9.	calculate	_____	_____
10.	electron	_____	_____

Grammar Exercise
Singular to Plural

Rewrite the following sentences in the singular.
Example: These electric currents flow through the wires.

This electric current flows through the wire.

1. We can measure the effects of electricity.

_____

2. There are 16 inches to one centimeter.

(1/16 centimeter)

_____

3. The protons and neutrons are in the center of the atom.

_____

4. Molecules join with other molecules (do not change) to form basic elements.

_____

5. Symbols are easier to use in mathemetical calculations.

_____

6. Electrons are necessary for generating electricity.

_____

7. These numbers refer to the voltages, not to the resistances.

_____

8. These phenomena change when the voltages are changed.

_____

UNITS IV & V COMPONENT IDENTIFICATION AND FUNCTION

Lesson I

Read the passage.

Every worker entering the electronics industry must learn to identify the basic parts he will be working with. He must recognize the parts, call them by their proper name, and be able to associate each part with its symbol. Electrical and electronic components are those parts connected to form an assembly. Together they produce a desired output. This lesson presents the most often used components, their symbols, and their functions.

VOCABULARY

Nouns

antenna
battery
capacitor
capacitance
fixed capacitor
variable capacitor
cell
inductor
air core inductor
iron core inductor
variable air core inductor
electrolyte
coil
conductor
diode
rectifier
circuit breaker
chassis
frame
ground
chassis ground
resistor
resistance
fixed resistor
potentiometer
circuit

Nouns (continued)

flow
direction
function
impulse
symbol
volt/voltage
power
electron
electric field
integrated circuit
semiconductor
silicon chip
jack plug
bulb
light emitting diode (LED)
microphone
speaker
switch
wafer switch
toggle switch
contact point
terminal
transistor
variable resistor
assembly

Verbs

used for
perform
transform
decrease
increase
break
flow

Verbs (continued)

prevent
melt
blow
store
surround
charge
measure

A: What's this?
B: It's a microphone.

A: What is its function?
B: It transforms air pressure changes into electrical impulses.

A: And what is this called?
B: A speaker.

A: What is it used for?
B: To transform electrical impulses into sound.

A: What is this component called?
B: It's an antenna.

A: What is the function of an antenna?
B: The antenna is the part of a radio that transmits or picks up radio waves.
Radio waves are also called electromagnetic waves.

A: You said this is a conductor? What is a conductor?
B: A conductor is material that electrons can move through.

A: What kind of material?
B: Copper is one good conductor.

A: What kind of conductor is in the picture?
B: It's a copper wire.

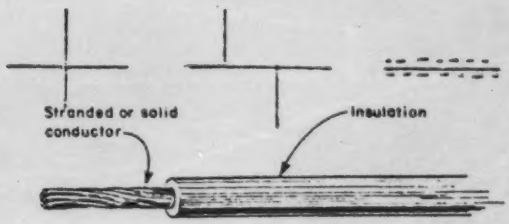
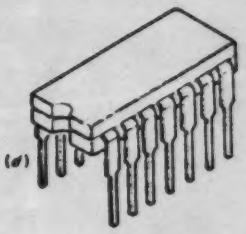


FIG. 2•1 Electrical wire.

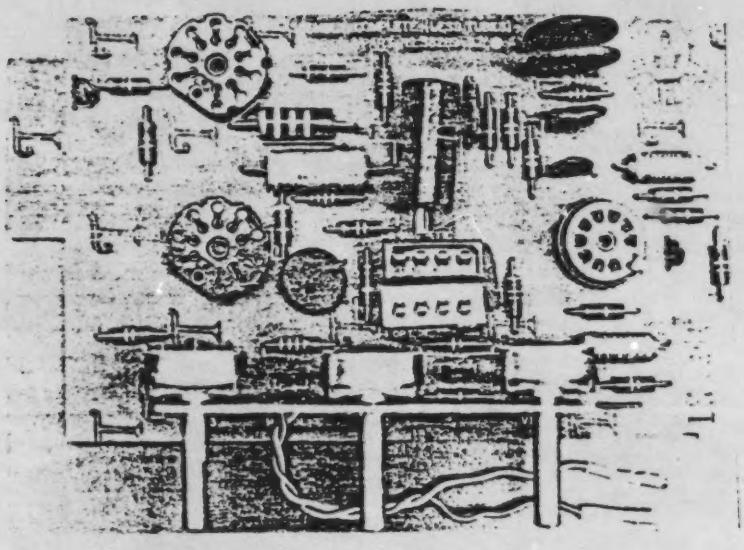
A: Could you tell me the name of this component?
B: It's an integrated circuit.



A: A what?
B: An integrated circuit.
I-N-T-E-G-R-A-T-E-D C-I-R-C-U-I-T

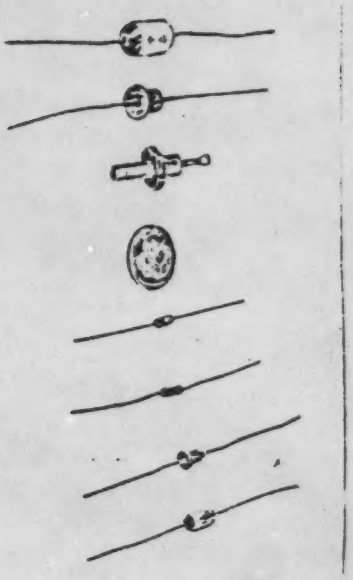
A: Integrated circuit.
B: Right.

A: What is it used for?
B: It's a type of semi-conductor. It holds a mixture of diodes and transistors and other components.



A: I can see you have a chassis here. Can you give me a definition of a chassis?
B: It's the basic unit that holds the components.

A: Does it do anything else?
B: Sometimes it serves as a conductor for electricity. Then it's called a chassis ground.



A: What do you call these?
B: Diodes. Another name for diodes is rectifiers.

A: What do they do?
B: They serve as one way switches. When the switch closes, the current can only flow in one direction.

A: Is a diode used for anything else?
B: It changes alternating current to direct current; AC to DC.

A: What are these?
B: Fuses.

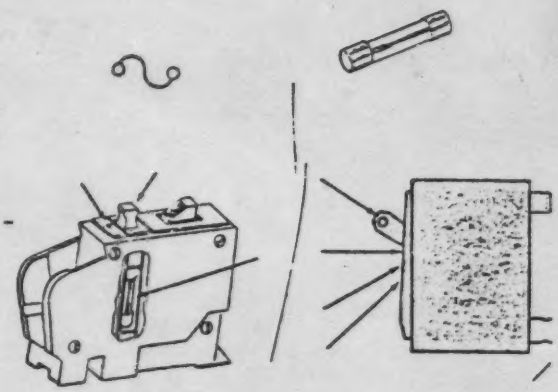
A: What is a fuse used for?
B: To break an electric circuit.

A: Why would anyone want to break the circuit?
B: It's to prevent fire when the current becomes excessive.

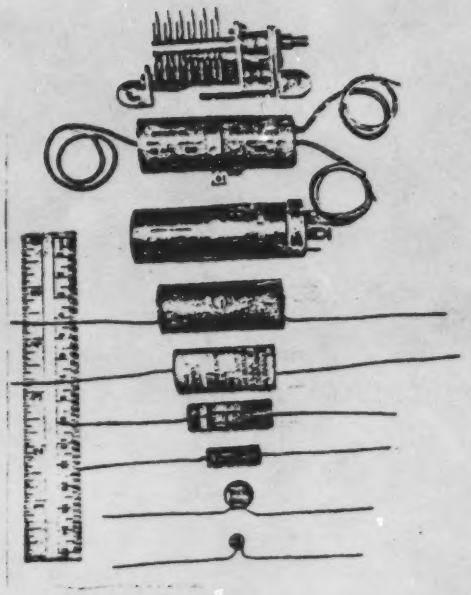
A: How does a fuse break the current?
B: The wire in a fuse melts at a low temperature.

A: What happens when the wire melts?
B: The fuse blows.

A: What's another name for fuse?
B: Circuit breaker.



A: What are these?
B: These are capacitors.



A: What do they do?
B: They store energy in their electric fields until it is needed.

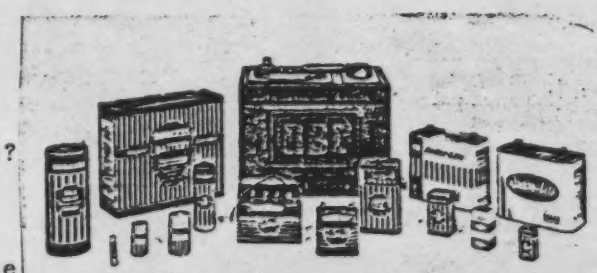
A: I don't understand what you mean by electric field.
B: It's hard to explain. For now, I'll tell you that it's an invisible force that surrounds a charged body. Later on that explanation will become clearer.

A: Is there another name for a capacitor?
B. Yes, another name is condenser.

A: What do you call the ability to store energy?
B: It's called capacitance.

A: Can you measure capacitance?
B: Yes, the unit of measure is a farad.

A: How many kinds of capacitors are there?
B: We have two types here: fixed and variable.



A: What are these called?
B: These are batteries.

A: What is a battery used for?
B: To produce direct current voltage.

A: Are all these batteries the same?
B: No, there are two kinds: a dry-cell battery and a wet-cell battery.

A: What's this component called?
B: It's a jack plug.

A: A jack plug?
B: That's right.

A: What's it used for?
B: It's used to make connections. The left one is a phone jack, the middle one is a regular plug, and the right picture shows a socket.

A: What are those?
B: Those are inductors. An inductor is a coil of wire. Another name for an inductor is a coil.

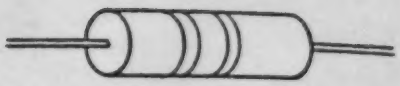
A: How does it work?
B: The wires act as a magnetic field. They oppose any change in the existing current.

A: How many kinds of inductors are there?
B: I know about 3 types: iron core coil, air core coil, and variable air core.

A: What do you call it when you say opposing change in an existing current?
B: It's called the property of inductance.

A: How is inductance measured?
B: In units called Henrys.

A: All of these components look different. What kind are they?
B: They are all resistors. They all perform the same function.



Fixed Resistor

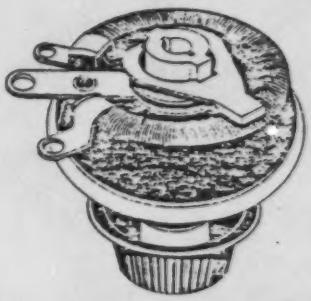
A: What do they do?
B: We've talked about resistance and ohms. Resistors decrease current. It's possible to control electric current with resistors.

Adjustable Resistor

A: What's the difference among all these resistors?
B: Well, there's the fixed resistor The amount of resistance cannot be changed in a fixed resistor.

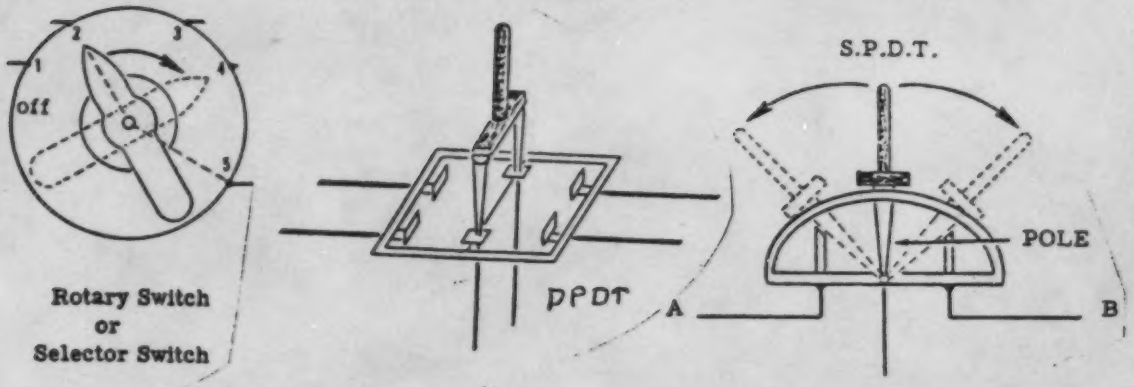
The amount of resistance can be changed in an adjustable resistor.

A variable resistor is used when the amount of resistance needs to be changed frequently.



Variable Resistor

A: What's another name for a variable resistor?
B: A potenciometer.



A: I don't recognize these. What are they?
B: Switches.

A: What kind of switch is the middle one?
B: A toggle switch or DPDT, which means double pole, double throw. The one on the left is a wafer switch. The right one is anSPST, which means single pole, single throw.

A: I know you turn on and turn off electricity with switches, but why are there different kinds of switches?
B: Switches allow short term connections. The wafer or rotary switch serves as a selector in radios or TV's.
A toggle switch is used in electrical and electronic work.

TRANSISTOR

A: I don't know what these are?
B: On the left is a vacuum tube, and on the right is a transistor.

A: Why are they together?
B: Both perform the same function. They are used in signal amplification or current control.

A: What's the difference between the two?
B: The transistor weighs less, is smaller and stronger than a vacuum tube. And the vacuum tube requires heater current.

LISTENING

Comprehension: Listen to the following statements. Complete them by choosing A, B, or C. Check the correct answer. (Note: the statement in parentheses is for the teacher's use only.)

1. (The purpose of an antenna is to . . .)

_____A. produce current for integrated circuits.

_____B. conduct electricity to a chassis.

_____C. pick up and transmit electromagnetic waves.

2. (A terminal is used as a . . .)

_____A. place of connection for wires and components.

_____B. circuit breaker.

_____C. battery to store electric charges.

3. (The function of a fuse is to . . .)

_____A. turn on/turn off the path of the current.

_____B. break the circuit when the current is too great.

_____C. measure current.

4. (A resistor is used for . . .)

_____A. conducting electricity.

_____B. transforming air pressure into sound.

_____C. limiting the flow of electricity.

5. (The function of a diode is to . . .)

_____A. conduct electrons in one direction.

_____B. oppose any change in the current.

_____C. store electric charges.

6. (The purpose of a capacitor is to . . .)

_____A. provide connections.

_____B. store electric charges.

_____C. produce direct current voltage.

7. (A conductor is used to . . .)

_____A. oppose any change in current.

_____B. transform electrical impulses into sound.

_____C. conduct electricity.

8. (An inductor . . .)

_____A. opposes any change in current.

_____B. stores electric charges.

_____C. breaks the circuit when the current is too great.

9. (A microphone is used for . . .)

_____A. limiting the flow of electricity.

_____B. transforming air pressure into electrical impulses.

_____C. transforming electrical impulses into sound.

10. (The function of a speaker is to . . .)

_____A. transform air pressure into electrical impulses.

_____B. transform electrical impulses into sound.

_____C. conduct electrons more easily in one direction.

XII. Practice identifying location of components.

Practice using prepositions of place.
(on, off, next to, in front of, in rear of, in back of, under, behind, on top of, at the bottom of, at the top of, on the left of, on the right of, in by, etc.)

S1: Where's the transformer?
S2: It's next to the battery.

S1: Where's the fuse?
S2: It's in that box.

S1: Where's the switch?
S2: It's on the left side.

XIII. Following directions using prepositions of place.

S1: Put the resistor next to the capacitor.
S2: (follows direction)

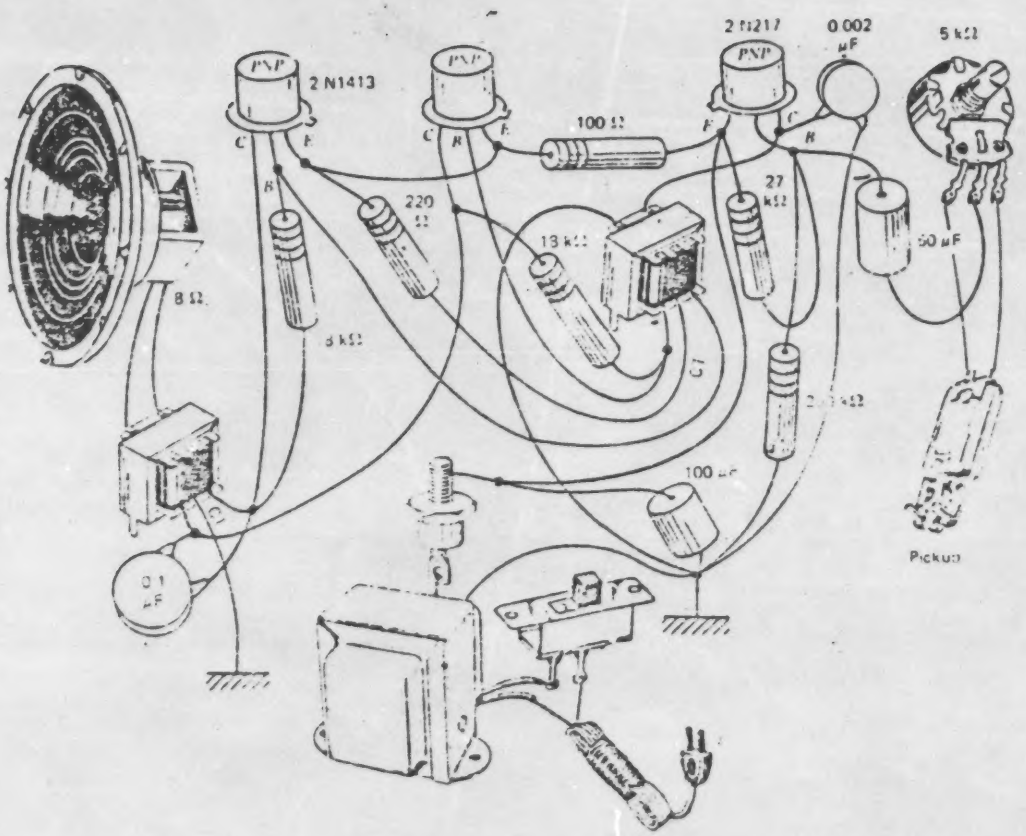


Figure 6-9 Push-pull type phonograph amplifier.

LESSON II

Exercises.

Fill in the blanks.

1. A _____ picks up and transmits electromagnetic waves.

2. An _____ opposes any change in the current.

3. A _____ connects the circuit temporarily by turning the current on.

4. A _____ stores electric charges.

5. A _____carries, conducts current changes from one coil to another.

6. _____is another name for an inductor.

7. _____ is another term for a diode.

8. A_____ works the same as a transistor.

MATCHING

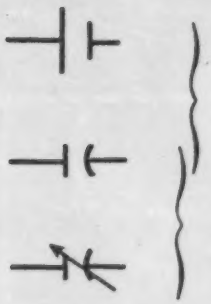
Match the components with their functios. Put the component number in the blank.

COMPONENT		FUNCTION
1 an antenna	_____	hold several components; resistors, capacitors, transistors
2. a battery	_____	break the circuit when the current is too great
3. a capacitor	_____	provide connections
4. an inductor (coil)	_____	pick up and transmit electromagnetic waves
5. a conductor	_____	limit the flow of current
6. a diode	_____	provide place of connection for wires and components in an electrical circuit
7. a fuse	_____	provide light
8. an integrated circuit	_____	produce direct current voltage
9. a jack plug	_____	transform electrical impulses into sound
10. a bulb	_____	store electric charges
11. a meter	_____	conduct electrons more easily in one direction
12. a microphone	_____	conduct electricity
13. a resistor	_____	oppose any change in the current
14. a speaker	_____	measure resistance, current, voltage, power, any electrical phenomena
15. a switch	_____	transform air pressure into electrical impulse
16. a terminal	_____	connect the circuit on a temporary basis -- turn on/ turn off the path of the current

17. a transistor	_____	use as a signal indicator
18. a vacuum tube	_____	enable conductors to perform specific functions in an empty space
19. a light emitting diode	_____	make temporary connections of leads or wires
20. a binding post	_____	carry, conduct current changes from one coil to another; amplify, etc.

SYMBOLS FOR COMPONENTS

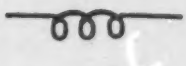
an antenna



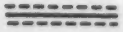
a battery

a basic capacitor

a variable capacitor



an inductor

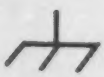


conductors

a diode

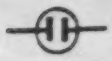
a fuse

a ground for a chassis



a ground for earth

a phone jack



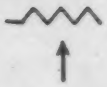
a plug

a light emitting diode

a meter

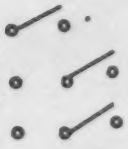
a microphone

a fixed resistor



a variable resistor

a speaker



switches SPST
DPDT

transistors
PNP

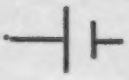
NPN

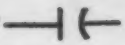
a tube

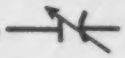
MATCHING SYMBOLS WITH COMPONENTS

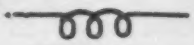
Put the number of the correct symbol in the blank.

1.

2. 

3. 

4. 

5. 

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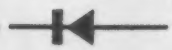
7. 

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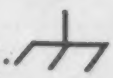
10. 

11.

_____A. a phone jack

_____B. a ground for a chassis

_____C. A battery

_____D. an inductor

_____E. an antenna

_____F. a basic capacitor

_____F. a ground for earth

_____G. a variable capacitor

_____H. conductors

_____I. a diode

_____J. a fuse

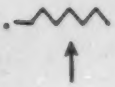
12. _____K. transistors PNP

13. _____L. a tube

14. _____M. switches

15. _____N. a plug

16. _____O. transistors NPN

17.  _____P. a light emitting diode

18. _____Q. a speaker

19. _____R. a variable resistor

20. _____S. a microphone

21. _____T. a fixed resistor

LESSON III

LANGUAGE

Pronunciation: Listen to the following words. Repeat them after the teacher.

antenna	æn - tén - ə
battery	bǽ - dir - iy
capacitor	kə - pǽ - si - ter
inductor	in - dʌ́k - ter
variable	vɔ́r - iy - ə - bəl
fixed	fikst
electrolyte	iy - lék - trə - lait
diode	daí - owd
rectifier	rék - ti - fai - ir
circuit	sír - kət
chassis	tʃǽ - siys
potenciometer	pi - tén - siy - ow - miy - dir
direction	di - rék - šən
impulse	ím - pəls
symbol	sím - bəl
power	páu - ir
integrated	ín - tə - grey - did
jack plug	dʒǽk - pləg
switch	switš
wafer	wéy - fir
toggle	tɑ́g - əl
used	yúwzd - for
charge	tšardʒ

Pronunciation Exercise: Listen to the following sounds and words. Write the word in the correct sound column.

AI	IY	I	ɛ

Teacher's Script for the above exercise.

sheep	hill	trick	mint
fry	beat	speak	ten
ship	feast	shed	cell
wreck	leave	live	in
well	sit	sense	chin
fly	slip	chip	crease
said	let	switch	pest
lie	well	vent	
my	tight	bet	
pie	sleep	bite	
friend	fix	sin	

GRAMMAR

Adverbials: Adverbials tell manner, place, frequency, and time. It often happens that more than one adverbial occurs in the final position. In this case general rules for the order in which they occur should be observed.

The order of adverbials usually are

MANNER + PLACE + FREQUENCY + TIME

Note: One sentence seldom has all four types.

1. The battery went dead on two occasions last week.
   /frequency/ /time/

2. The technician worked very quickly in the machine room
   /manner/ /place/

   yesterday.
   /time/

3. The resistor was tested very thoroughly in the lab
   /manner/ /place/

   several times last week.
   /frequency/ /time/

Adverbials of the same type follow an order of specific to general.

1. The student request for components is heaviest after

   8:00 A.M. in the fall semester.
   /specific/ /general/

2. Three new generators were recently installed

   in the power station near the dam in the mountains
   /specific/ /specific/ /general/

   south of Morgan.
   /general/

Exercise: Put the adverbials in the parentheses in the correct order at the end of each sentence.

1. The efficiency of the conductor was tested _____

_____.

(in one of our labs)
(on three occasions)
(most carefully)
(last month)

2. We examined the chassis ground_____.

(in detail)
(last week)

3. The antenna will be located _____

_____.

(in the lower part of the receiver)
(between the switch and the circuit breaker)

4. We used the emergency phone_____

_____

(in winter)
(on two or three occasions)
(last year)

5. The correct information on components is given _____

_____.

(in the book on ESL electronics)
(at the end of Unit 3)
(at the bottom of the page)

UNIT VI BASIC SOLDERING

Lesson I

Read the passage.

Soldering is the process of uniting two clean pieces of metal with a thin layer of a third metal applied in a molten state. In metalwork, there are three types of soldering: brazing, silver soldering, and soft soldering. Soft soldering is practiced in electrical and electronic work. This section deals with soft soldering in which wires are soldered together. The metal that is heated to a molten state is called solder. Solder is an alloy of tin and lead and is normally manufactured in wire form. Soldering may connect wires to a terminal or one electrical wire to another.

Vocabulary: Repeat for correct pronunciation.

Nouns	Verbs	Expressions
solder	solder	Where do we start?
soldering	employ	What do I do next?
layer	remove	What did I do wrong?
state	contaminate	Did I do it right?
alloy	ensure	Let's check it.
wire	manufacture	
heat	melt	
insulation	apply	
oxides	preheat	
matter	heat	
oxidation	transfer	
wetting	spread	
skill	penetrate	
flux	dampen	
resin	inspect	
application	tin	
tinning		
bond		
core	Adjectives	
joint		
sponge	synthetic	
procedure	natural	

How Does It Work?

As for the soldering procedure itself, it requires that all surfaces that are to be united be thoroughly cleaned and tinned; that a good hot soldering iron be used; and that the heat be transferred properly. Finally it requires that a solder alloy having the right amount of tin-to-lead content, along with resin core, be used.

Lesson II

DIALOGS

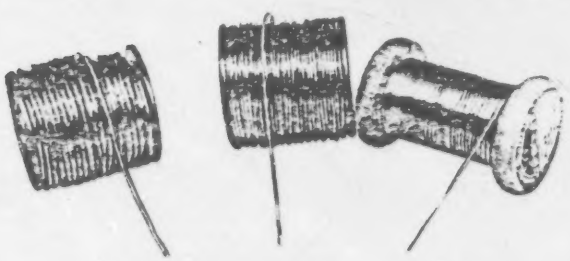
Where Do We Start?

A: I'm ready to learn about soldering. Where do we start?
B: First you need the right equipment. To start, we're going to tin the tip of a soldering iron.

A: What equipment do we need?
B: A soldering iron with an iron-clad tip.
A soldering iron stand.
A sponge. The sponge must be natural, not synthetic.

A: Okay. I got everything together. What do we do next?
B: We also need some wire solder. Be sure it has a resin core.

A: Here's the solder.
B: Good. We're ready to begin.



Solder in wire form.

A heavy-duty soldering iron.

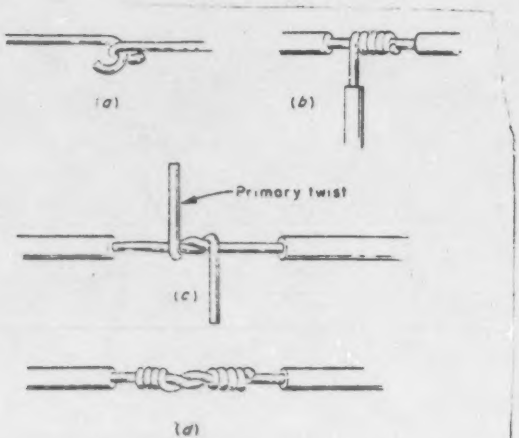
Mechanical Connection

When a wire is to be soldered to a terminal, or to another wire, a tight mechanical connection should be accomplished first. Solder alone is not sufficient to support any appreciable weight. NASA has set standards for making mechanical connections in the aerospace industry. NASA specifies that a wire lead connected to a terminal be wrapped around the terminal considerably less than a full turn.

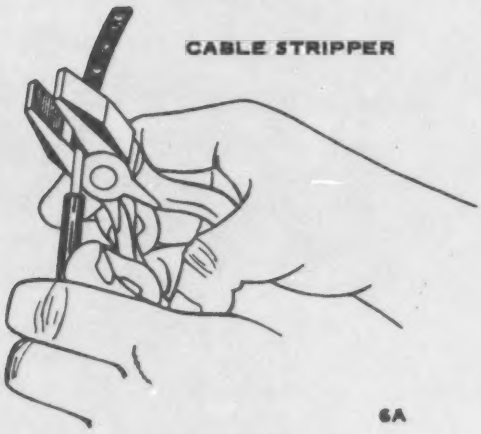
A wire lead is wrapped around a terminal to accomplish the mechanical connection. When two wires are joind together (without the aid of a tie point), they are said to be spliced.

A: What are some things I need to remember about splicing?
B: Splice copper wires together in three different rings. Be careful not to damage the wire.

A: What about the number of turns?
B: Each wrap of the hook splice should not be more than one complete turn.
Place the wire ring so that is steady and self-supporting.

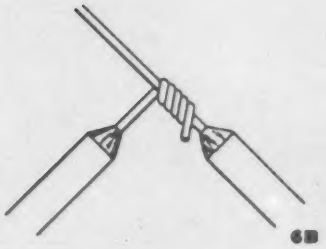


Wire-splicing methods: (a) Hook splice. (b) Tap splice. (c) Western Union splice.



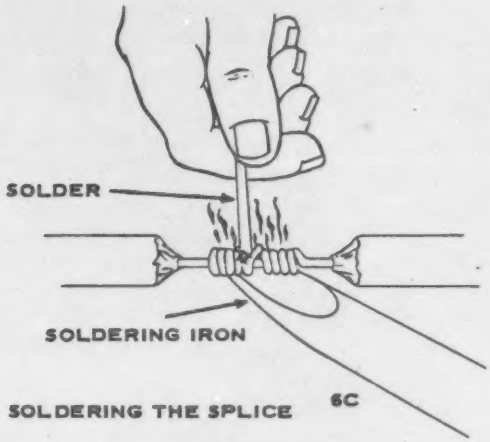
6A

REMOVING THE INSULATION



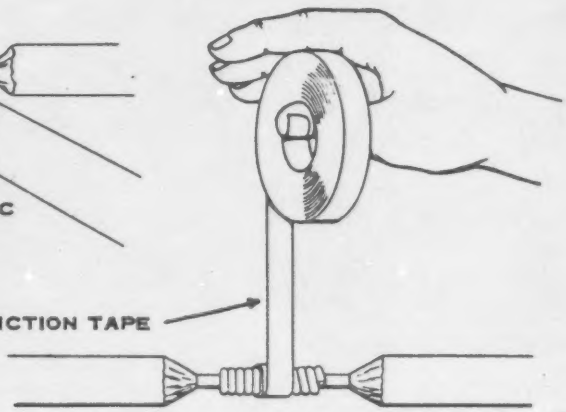
6B

TWISTING THE WIRES TOGETHER



SOLDERING THE SPLICE

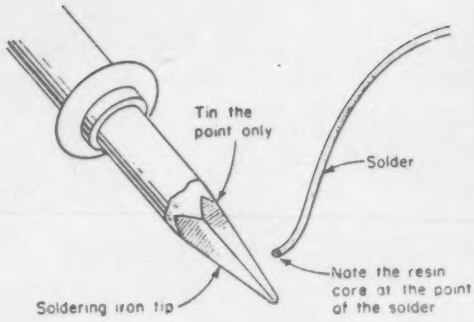
6C



6D

INSULATING THE SPLICE

The proper way to tin a wire when using a soldering



Tinning the soldering-iron tip.

A: I'm ready.
B: Good. Follow these steps:

1. Lightly dampen the sponge. You will not use it right away.
   Don't use too much water.

2. Place the soldering iron on the stand.
   Be sure the tip is pointing toward you.

3. Plug the cord of the soldering iron in.

4. When the tip of the soldering iron is hot, apply the wire solder to the point of the tip until the solder melts.

5. Turn the soldering iron until the tip is completely covered with a film of solder.

6. Gently wipe off the tip of the soldering iron with the sponge. Pull the soldering iron toward you so you wipe the solder toward the point.

7. Inspect to see if the film of molten solder is smooth and shiny and completely covers the point of the tip. Remove any excess solder with the sponge again.

8. If necessary, repeat the application of solder.

9. If the area covered with solder passes inspection, this area is said to be tinned.

10. An area that can't be properly tinned may not have been cleaned properly.

A: Now we've completed the first part of the procedure. What do we do next?

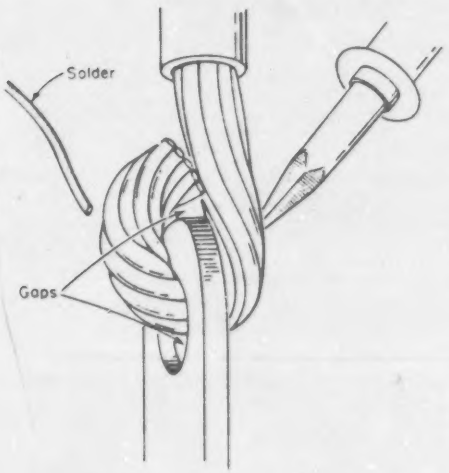
B: Next we tin the surface of the wire we are soldering. We follow these steps.

We get the wire ready.

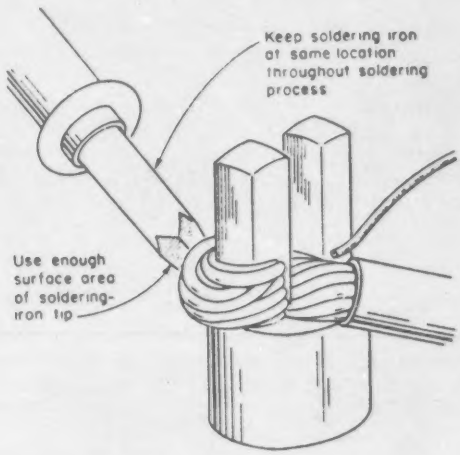
1. Remove insulation from the wire with a wire stripper, if necessary.

2. If the wire is oxidized, use fine sandpaper or emery cloth to clean the surface.

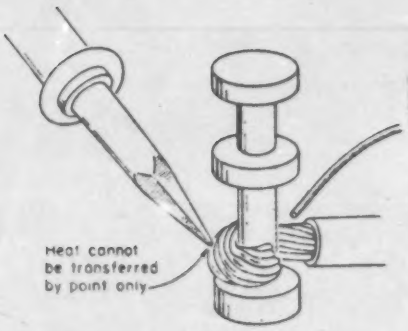
3. Apply a small amount of solder to the soldering iron after you have tinned the tip. The extra solder will ensure that heat is transferred to the wire you are tinning by providing a soft cushion of molten metal for the wire.



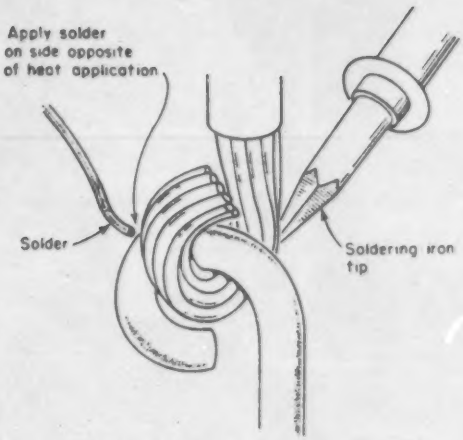
Solder should not be used to fill gaps.



Proper application of heat.



Improper application of heat.



Proper application of solder.

4. Lay the clean copper wire on top of the soldering iron tip.

5. Apply solder to the hot wire directly. Do not let the solder wire touch the tip of the soldering iron.

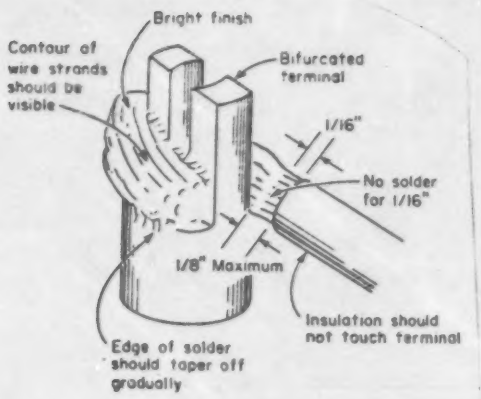
6. Apply solder to all clean areas of the copper wire to be tinned. Work quickly to avoid burning the insulation still on the wire. If heat application is prolonged, you may cause the molten resin to drain away, which in turn will prevent the solder from spreading smoothly.

7. Put the solder wire aside.

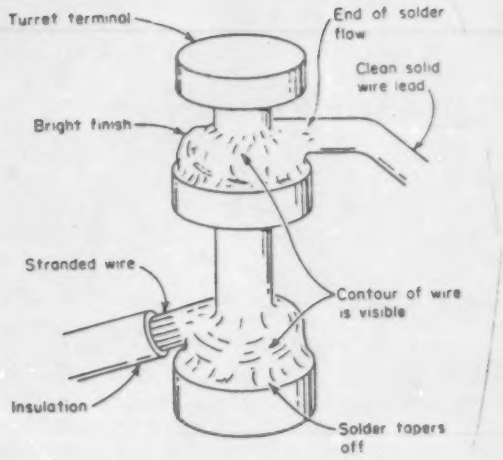
8. Carefully lift the copper wire from the soldering iron.

9. Inspect the tinned copper wire. No sharp points should be visible. The film of solder should be smooth and shiny.

10. If the wire does not pass inspection, repeat the procedure.



Proper soldering results.



A: Now the splicing is done, and the tinning.
What's next?
B: We're ready to join two wires.
Here goes.

1. Wipe the soldering iron with the damp sponge.

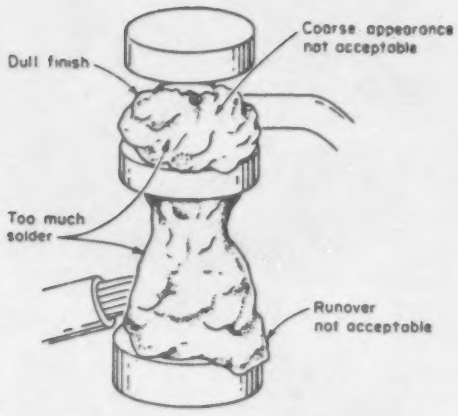
2. Apply a small amount of solder to the tip of the soldering iron for proper heat transfer.

3. Apply the soldering iron to one side of each splice while holding the wire solder on the opposite side of the splice.

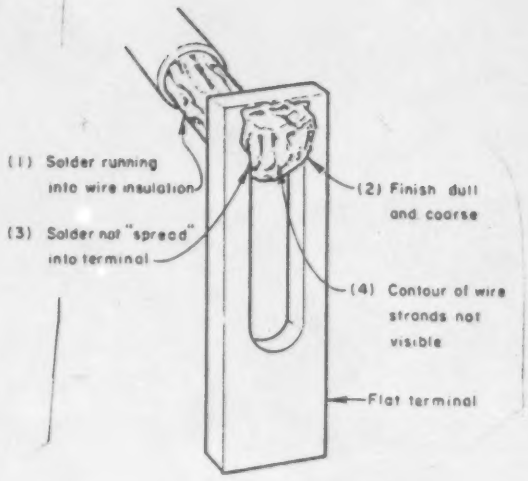
4. Do not allow the wire ring to move until the solder joint has cooled enough for the solder to solidify.

5. Inspect the soldered joint to make sure it is smooth and shiny. No sharp points should be visible.

A: Well, I followed the directions.
How does it look.
B: Let's check it. It looks pretty good.
Not bad for the first time.
Now let's try it again.



Improper soldering results.


(1) Solder running into wire insulation
(2) Finish dull and coarse
(3) Solder not "spread" into terminal
(4) Contour of wire strands not visible
Flat terminal

bad soldering.

More Tips on Solder Application

Solder should be melted by the joint to be soldered, not by the soldering iron tip. If the joint is heated properly, the solder will melt when the joint is touched. Solder should never be applied to the hot soldering-iron tip and allowed to run in a molten state on the joint to be soldered. Solder should be applied on the side of the joint opposite to that of heat application.

When gaps in the wire wrap or in the terminal exist, they should not be filled with solder unless it is specified. Proper soldering results are obtained only when the amount of solder used is sufficient to accomplish a good electrical connection. Solder should not run into the wire insulation, nor should the insulation be allowed to touch the terminal.

COMPREHENSION

Listening: True or False

Listen to the statements the teacher reads. Mark T in the blank if the statement is True and F if the statement is False.

(Teacher's Script)

1. In electronic work, we use soft soldering.
2. Solder is an alloy of tin and lead.
3. Soldering is enough to hold two wires together.
4. The amount of tin and lead in solder is always 50-50.
5. Tinning is not necessary if there is enough heat.
6. Inspection is necessary at all steps.
7. It is not necessary to remove wire insulation before soldering.
8. Solder should be smooth and shiny.
9. Some wires need to be spliced before soldering.
10. The splice should be wrapped six complete turns.

Students' Answer Sheet.

1.	_____	6.	_____
2.	_____	7.	_____
3.	_____	8.	_____
4.	_____	9.	_____
5.	_____	10.	_____

Lesson II

Exercises

Fill in the blanks.

Before we can join two pieces of _____wire together, we must be sure that they are thoroughly _____and tinned. The soldering iron must be in good _____condition and very_____so that the heat can be _____properly. Also, we must use an _____having the amount of tin to _____content.

Arrange these steps in the soldering process in their proper order. Put the number for each step in the blanks.

A. _____Plug in the soldering iron.

B. _____Wipe the tip of the soldering iron with a sponge.

C. _____Remove any excess solder with the sponge again.

D. _____Dampen the sponge.

E. _____If necessary, repeat the application of solder.

F. _____Put the soldering iron on the stand pointing the tip toward you.

G. _____Inspect to make sure the film of solder covering the tip of the point is smooth and shiny.

H. _____Turn the soldering iron until the tip is covered with a thin layer of solder.

I. _____After passing inspection, this area is tinned.

J. _____Apply the wire solder to the tip of the point of the soldering iron until the solder melts.

Lesson III

LANGUAGE

Pronunciation: Repeat the following words after the teacher.

solder	/sá - dir/
oxide	/ak - said/
osication	/ak - si - déy - sən/
wetting	/wé - diŋ/
flux	/fləks/
procedure	/prə - siý - djir/
sponge	/spənǰ/
splicing	/splái - siŋ/
contaminate	/kən - tǽm - in - eyt/
manufacture	/mǽn - yuw - fæk - tšir/
penetrate	/pɛ̃n - i - treyt/
synthetic	/sin - ɵé - dik/
resin	/ré - zin/

Sounds a æ

You will hear ten words. If the word contains the vowel /a/, write /a/ in the space. If the word contains the vowel /æ/, write æ in the space.

Teacher's Script

1. solder
2. accomplish
3. wrap
4. practice
5. electronic
6. alloy
7. manufactured
8. contaminate
9. another
10. oxide

Student's Answer Sheet

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Write four words that rhyme with hot and four words that rhyme with hat.

1. _____
2. _____
3. _____
4. _____

1. _____
2. _____
3. _____
4. _____

Grammar: Chronological Order

Expressions of time

In explaining how to do something, expressions of time are used to show which step goes before the next:

first	after that
second	after . . . . .
third (etc.)	next
then	last
at this point	finally

Write the steps in the soldering process, using expressions of time at each step.

First you need to get all of the equipment together.